V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	20%		20%	
121	Management of Range Resources	20%		20%	
131	Alternative Uses of Land	0%		10%	
133	Pollution Prevention and Mitigation	0%		10%	
401	Structures, Facilities, and General Purpose Farm Supplies	10%		10%	
402	Engineering Systems and Equipment	20%		20%	
608	Community Resource Planning and Development	30%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	3.2	0.0
Actual Paid Professional	4.0	0.0	3.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
42574	0	131410	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
42574	0	131410	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Media will be used to familiarize the public with UW College of Agriculture and Natural Resources areas of programming and personnel in regard to sustainable energy. Media releases in local newspapers, radio spots and television advertisements will inform the public of upcoming extension programs. Newsletter articles distributed both electronically and through the mail by county offices, area teams, and the University of Wyoming will reach general public and agriculture producers locally, regionally, and statewide. Public educational programs with invited speakers and extension specialists and educators presenting research-based information will continue to be held in response to local, state, and national energy sustainability. Demonstrations of technology and skills training will be included in education curriculum to enhance educational effectiveness. Field tours will be organized to provide producers with the opportunity to observe industry procedure (i.e., tour of an ethanol plant).

The Sustainable Agriculture Research and Extension Center (SAREC) located at Lingle, Wyoming will provide a resource base for integrating agriculture production and renewable energy based programs.

Educational programs will emphasize sustainable energy practices such as bio-fuels and wind energy, reclamation and restoration of disturbed lands, and energy conservation practices. Other methods will include individual interaction with landowners educating them on resources available to assist them with sustainable energy practices. UW Extension will provide coordination with other colleges on the UW campus such as Engineering and the School of Energy Resources, state and federal agencies to provide education on this topic, and funding for this effort. UW Extension will also provide educational opportunities for professionals involved with reclamation and restoration of disturbed lands.

The University of Wyoming's College of Agriculture and Natural Resources will conduct research and direct extension programming efforts to help ensure prudent use of the state's precious resources.

2. Brief description of the target audience

The University of Wyoming is committed to reaching underrepresented groups and individuals and to implementing the objectives of equal opportunity regulations relative to the consideration and treatment of clientele for participation in all programs regardless of their race, national origin, gender, age, religion, or disability. Participants will include policy makers for county, state, and federal government agencies, crop producers, livestock producers, energy companies, general public, and the scientific community. An existing secondary audience will be the media, general public, and interest groups not directly involved in

production agriculture (i.e., environmental groups). Energy conservation methods will be targeted at both agriculture and general public audiences.

3. How was eXtension used?

The UW Extension energy extension coordinator serves on the eXtension energy community of practice. eXtension is used as a resource for educators and the public. the Web site link is prominently displayed on the UW Extension home page. UW Extension educators are aware of professional development opportunities available through eXtension.

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1100	100000	300	1000

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2013
Actual:	2

Patents listed

1. Method for Enhanced Fermentation through the Destruction of Mitochondrial DNA. Applied for 12/02/2013.
2. Enhanced Yeast Fermentation Platform using Yeast that Lack Mitochondrial DNA and Containing Growth Improving Mutations. Applied for 04/03/2013.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	3	5	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of individuals participating in sustainable energy programs. Target is the number of contacts.

Year	Actual
2013	1400

Output #2

Output Measure

- Determine ecosystem services affected by energy development and reclamation efforts. Target is number of projects.

Year	Actual
2013	146

Output #3

Output Measure

- Evaluate the potential for production of bioenergy. Target is number of projects.

Year	Actual
2013	5

Output #4

Output Measure

- Number of educational programs or activities focusing on sustainable energy by UW Extension. Target is the number of educational programs implemented.

Year	Actual
2013	35

Output #5

Output Measure

- Number of collaborative partnerships formed to address sustainable energy in Wyoming. Target is the number of partnerships.

Year	Actual
2013	25

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Awareness created focusing on sustainable energy topics. Target is the number of individuals reporting this outcome.
2	Partnerships will be developed with agencies and organizations to expand sustainable energy efforts. Target is the number of partnerships formed.
3	New technologies or devices used in ag production systems and/or farmsteads. Target is the number of new technologies developed.
4	Create awareness of research on ecosystem services affected by energy development and reclamation efforts. Target is number of projects.
5	Create awareness of research on the potential to produce bioenergy. Target is number of projects.

Outcome #1

1. Outcome Measures

Awareness created focusing on sustainable energy topics. Target is the number of individuals reporting this outcome.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1400

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The State of Wyoming is well known for being a critical source of the nation's supply of natural resources. Because fossil fuels are essentially an irreplaceable base for Wyoming's vibrant energy industry, the College of Agriculture and Natural Resources conducts research and direct extension programming efforts to help ensure prudent use of the state's precious resources. In addition to fossil fuel resources, Wyoming also possesses abundant renewable energy resources including wind, solar, hydroelectric, geothermal, and biomass. Both small-scale, such solar photovoltiacs or geothermal heat pumps, and utility-scale, primarily wind energy, are important issues. Development of renewable technologies such as specific systems that can be used in agriculture production and/or farmsteads and small-scale power generation where power can be sold such as wind energy are also important issues. Conservation and preservation of our natural resources, both land and water is an ongoing effort for both extension and research.

What has been done

The University of Wyoming College of Agriculture and Natural Resources research and extension efforts in sustainable energy focus on efficiency and conservation specifically in relation to farm and agriculture production. In addition, residential and public conservation education is targeted toward the general public and businesses. In fall 2009, UW Extension partnered with the School of Energy Resources at UW to fund an energy extension coordinator who provides leadership and coordination for extension energy programs in the college. Initial training for field extension educators was conducted; a Western SARE grant ($110,000) was obtained by Montana State University in collaboration with the UW Extension energy extension coordinator to implement a Western Region training on energy issues. In addition to educational programs to raise

awareness and knowledge, UW Extension has developed a Web site for information, publications, and a set of educational videos. To maximize outreach efforts, partnerships have been developed with the College of Engineering and Applied Science, School of Energy Resources, the Wyoming State Energy Office, Wind Energy Research Center, USDA Rural Development, Natural Resource Conservation Service, and the Wyoming Business Council. UW Range specialists and area educators have partnered with the UW Reclamation and Restoration Center to develop and implement Reclamation 101 schools for agriculture land owners and agency personnel.

Results
In 2013, UW Extension initiated an issue team focusing on sustainable energy issues. 100 percent of participants in the 35 programs held reported gaining awareness of the topic and gaining knowledge. Early partnership efforts have resulted in increasing effectiveness of programs through multiple collaborators.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
121	Management of Range Resources
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
401	Structures, Facilities, and General Purpose Farm Supplies
402	Engineering Systems and Equipment
608	Community Resource Planning and Development

Outcome #2

1. Outcome Measures

Partnerships will be developed with agencies and organizations to expand sustainable energy efforts. Target is the number of partnerships formed.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	25

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The State of Wyoming is well known for being a critical source of the nation's supply of natural resources. Because fossil fuels are essentially an irreplaceable base for Wyoming's vibrant energy industry, the College of Agriculture and Natural Resources strives to conduct research and direct extension programming efforts to help ensure prudent use of the state's precious resources. In addition to fossil fuel resources, Wyoming also possesses abundant renewable energy resources including wind, solar, hydroelectric, geothermal, and biomass. Both small-scale, such solar photovoltiacs or geothermal heat pumps, and utility-scale, primarily wind energy, are important issues. Development of renewable technologies such as specific systems that can be used in agriculture production and/or farmsteads and small scale power generation where power can be sold such as wind energy are also important issues. As an energy rich state, conservation and preservation of our natural resources, both land and water is an ongoing effort for both extension and research.

What has been done

To maximize outreach efforts, partnerships have been developed with the College of Engineering and Applied Science, School of Energy Resources, the Wyoming State Energy Office, Wind Energy Resource Center, USDA Rural Development, Natural Resource Conservation Service, and the Wyoming Business Council. The UW Reclamation and Restoration Center, Energy Industry, local partners focusing on local food production are additional partners.

Results

Partnerships have increased resources, both financial and human capital to maximize outreach efforts. Partnerships have leveraged funding to support an innovative energy internal grant program for UW Extension. Integrated program efforts are in progress.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
121	Management of Range Resources
401	Structures, Facilities, and General Purpose Farm Supplies
402	Engineering Systems and Equipment
608	Community Resource Planning and Development

Outcome #3

1. Outcome Measures

New technologies or devices used in ag production systems and/or farmsteads. Target is the number of new technologies developed.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Create awareness of research on ecosystem services affected by energy development and reclamation efforts. Target is number of projects.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	12

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Domestic energy extraction is critical to national security. Yet invasive species introduced by industry activities limits the agricultural productivity and ecosystem integrity of western wild lands and challenges land managers to return ecosystem services of clean air, water and habitat for wildlife species of concern. Effective reclamation efforts are needed to retain sustainable rangelands for the future and provide our citizens with viable wildlife populations, clean water and natural resources for future generations.

What has been done
A series of research studies on gas-pad extraction sites have been initiated to examine and identify native plant species that are especially competitive with exotic plant invasions. The native species examined will provide a tool to allow successful restoration that enables continued domestic energy production. We examine native populations for their resilience in the face of invasion of exotic species such as Russian knapweed and halogeton which threaten the agricultural productivity of invaded lands.

Results
In identifying native species for use in reclamation we can facilitate continued energy extraction and provisioning of other ecosystem services for future citizens.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
121	Management of Range Resources
131	Alternative Uses of Land

402	Engineering Systems and Equipment
608	Community Resource Planning and Development

Outcome #5

1. Outcome Measures

Create awareness of research on the potential to produce bioenergy. Target is number of projects.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Fermentation of plant biomass by the yeast Saccharomyces cerevisiae to produce biofuels and high value chemicals is a multi-billion dollar per year industry. Significant research and development efforts have been placed into optimizing the process, with the majority of the efforts being specific for the desired product. The research being conducted will potentially increase the efficiency of fermentation processes used in biofuel production reducing costs, increasing profits, reducing dependence on Federal subsidies, and offsetting costs in other aspects of biofuel production.

What has been done
This increase in fermentation comes at a price, namely slower growth, preventing commercially viable use of such yeast strains. However, researchers have identified genetic changes in yeast lacking mitochondrial oxidative function that allows rapid and robust yeast cell growth while maintaining enhanced fermentative outcomes. This platform technology has the potential to enhance the efficiency of commercial fermentations used for biofuel and gateway chemical production. We have demonstrated a reproducible 25-fold enhancement in ethanol production using laboratory strains. Our goal is to create the same changes in industrial strains of yeast and measure the efficiency of fermentation. Further, we will determine if these mutations have pleiotropic consequences to desirable phenotypes in the industrial strains.

Results
Enhanced production of fermentation products will increase the use of bio-based materials making production economically competitive with traditional petroleum production processes. Ultimately, this could decrease the policy conflicts involved in using plant material that can be

used for food in a fuel or chemical production process, largely through enhanced efficiency. Further, the improved fermentation process has the potential to allow the adoption of non-food plant sources (e.g., cellulosic biomass) more economical and hence more likely to occur.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation
401	Structures, Facilities, and General Purpose Farm Supplies
402	Engineering Systems and Equipment

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

Funding for this new program is essential in development and implementation of both research and extension efforts. Weather extremes are a factor in agriculture production outcomes regarding crops for alternative fuels.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

End of session written evaluations were utilized to collect outcome data. In addition personal follow-up with the local educator or UW Energy Extension Coordinator was conducted. 100% of program participants indicated they increased awareness and knowledge as a result of educational efforts. Educators and professional agency personnel who participated in training on renewable energy and reclamation issues reported increased knowledge, skills and increased confidence in disseminating information on these topics.

Program participants reported that in some instances, alternative energy options are not cost effective therefore contributed to decision making which is a positive outcome.

Key Items of Evaluation

Increased awareness and knowledge on sustainable energy issues

Program participants reported that in some instances, alternative energy options are not

cost effective therefore contributed to decision making which is a positive outcome.